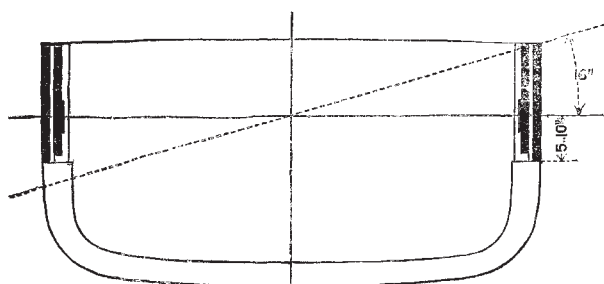
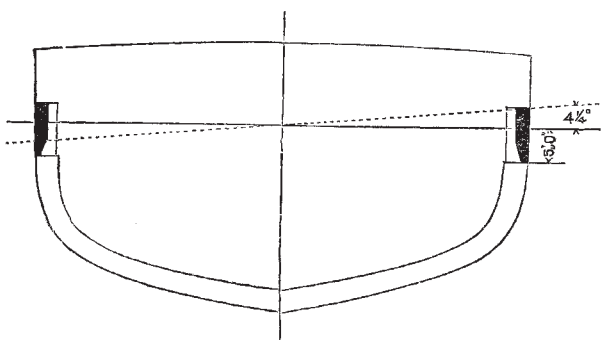
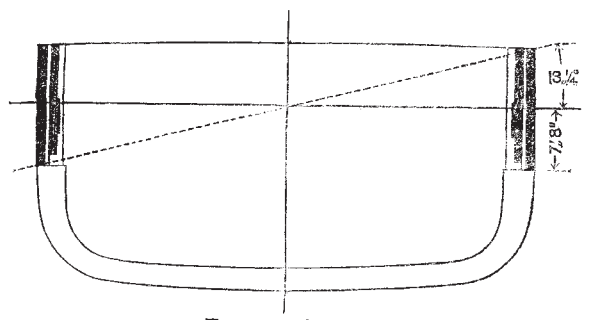
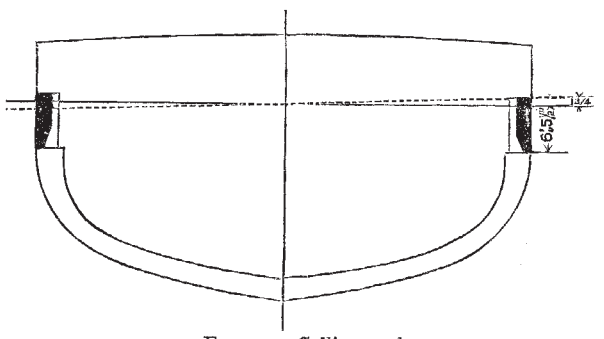


the armour to a depth of at least 6 feet below the normal water-line, and as much deeper as individual cases would allow. It is evident, therefore, that the ships of the *Admiral* class are deficient in this respect unless and until their unarmoured ends are flooded.

FIG. 1.—*Agamemnon*.FIG. 2.—*Collingwood*.FIG. 3.—*Agamemnon*.FIG. 4.—*Collingwood*.

Reverting to the still more important question of height of armoured freeboard (*i.e.* the height of the top edge of armour at side above the water), we will now give some figures. The *Agamemnon*, with her armoured freeboard

of 9 feet 6 inches in the uninjured condition, can be inclined to the angle of 16 degrees before the top edge of her armour touches the water, as shown by the dotted line in Fig. 1; and even when her unarmoured ends are flooded, and her freeboard therefore reduced to 7 feet 8 inches, she can still be inclined (assuming for the moment that she would still have stability) to the angle of 13½ degrees before her armour is brought beneath the water; this is shown in Fig. 3. But the *Collingwood* has so ridiculously shallow a partial belt (only 2 feet 6 inches above the water in the uninjured condition) that an inclination of only 4½ degrees causes her armour to disappear altogether in smooth water. When her ends are flooded her armoured freeboard is actually reduced to no more than 12½ inches, which is as much as to say that at sea she would have no armoured freeboard at all in that condition, for an inclination of but 1½ degrees is sufficient to bury her armour completely, even in smooth water. The two conditions of the *Collingwood* are shown in Fig. 2 and Fig. 4 respectively.

These alarming facts, thus clearly brought into view are of themselves sufficient to explain Sir Edward Reed's distrust of the *Admiral* class of ship, and his very strong condemnation of these ships can be readily understood when we remember, further, that in his opinion the excessive shortening of the armoured part in the whole of these ships has introduced such elements of danger into them as to render them unfit to take their place in the line of battle, even apart from the considerations previously set forth.

THE AMERICAN ASSOCIATION

Proceedings of the American Association for the Advancement of Science (Thirty-Second Meeting), held at Minneapolis, Minn., August, 1883. (Salem: Published by the Permanent Secretary, 1884.)

THE record of the proceedings of the thirty-second meeting of the American Association forms a volume considerably less bulky than that issued by the British Association, as it consists of 598 pages, the corresponding volume of the older Association numbering 884 pages. The difference between the two volumes, as records of science, is about in the same proportion. Addresses, reports, and abstracts of papers take up 468 pages in the book before us, while in the Southport volume the same subjects occupy 660 pages. In printing and paper the American volume is decidedly the superior of the British, but, as a set-off, it is issued in a paper cover; the price, however, is only 1.50 dollars. The smaller size of the volume is accounted for by the fact that considerably fewer papers appear to have been read before the American Association than before the British. We note also another point of difference, certainly not to the advantage of the American volume: the reports on the state of science, so conspicuous and valuable a feature in the British volume, are remarkable in the American chiefly by their absence. We venture to suggest to the officers and Committee of the latter Association that they would add largely to its importance and stability by developing this branch of its work. At the present time, when scientific societies for special purposes are so numerous, their meetings and journals will always compete successfully with those of an all-embracing Association such as the British and others formed on a similar plan

for original papers of real importance; but the task of recording progress, of acting as the historians of science, is rightly declined by societies which aim at advance rather than at retrospect. Hence this most important function can be best discharged by these great Associations, and it will always suffice to save them from degenerating into scientific camp-meetings or picnics.

The Sections in the American Association are equally numerous with those in the British at the present time, though differently arranged. Mathematics and Physics are divided, Geology and Geography united; Histology and Microscopy form a section separate from Biology. We doubt the advantages of the union in the second case, and of the separation in the third. That no address is printed in this volume, and that the only record of the proceedings of the Section of Histology and Microscopy is the statement that, although some meetings took place, no papers were read before it, seems an indication that, as in Britain, its subjects might safely be merged in Biology, the latter Section having the power of temporary subdivision.

In another respect too the American differs from the British Association. In the latter the delivery of an address is the first official act of its President, in the former it is the last. The address at Minneapolis was delivered by Principal (now Sir William) Dawson, and is characterised by the scientific caution and literary ability of its author. It gives a critical sketch of the results of geology, more especially with reference to the development of the earlier rocks and to the evolution of living creatures. In regard to the former, Sir W. Dawson inclines to drawing a marked line of separation between the Lower Laurentian or Ottawa gneiss of Sir W. Logan and the Middle Laurentian or the Grenville series of the same, which is characterised by beds of limestone and dolomite, "quartzite, quartzose gneisses, and even pebble beds," besides graphite, iron ore, and the debatable *cozoon*, which Sir W. Dawson considers as indicating the existence of land surfaces of the fundamental gneiss. The Upper Laurentian or Norian series is noticed with due caution, though it is regarded as decidedly younger than the preceding formation. The Huronian, Montalban, and Taconian (Lower Taconic of Emmons) are next mentioned, but the author, though inclining to the views of Dr. Sterry Hunt as to their order of succession, forbears to dogmatise as to their precise relations either mutually or with "certain doubtful deposits around Lake Superior." With regard to the development of life, he is decidedly adverse to the evolution school among biologists, but is not able to add anything material to the familiar arguments of its opponents. The address concludes with a brief notice of some of the obscure markings, variously referred by palæontologists to algæ, protozoa, and tracks of various animals, and with a critical sketch of the theories relating to the Glacial Epoch, in which he expresses himself as opposed to the extreme views of the former extension of land-ice and its erosive action which are favoured by some geologists.

Two other papers are given as "read in General Sessions," which we presume may be regarded as in some respect analogous with the evening discourses at the British meetings. The one by Dr. Sterry Hunt, "On a Classification of the Natural Sciences," is printed in abstract

only; the other, by Prof. E. D. Cope, entitled "The Evidence for Evolution in the History of the Extinct Mammalia," is an extremely able and temperate sketch of the views antagonistic to those entertained by the retiring President. "The German Survey of the Northern Heavens" forms the subject of an interesting address by Prof. W. A. Rogers, who presided over the section of Mathematics and Astronomy, and Prof. H. A. Rowland delivered a "Plea for Pure Science" to the section of Physics. Both these sections received a considerable number of communications. The section of Chemistry does not appear to have had a special address, and the number of papers read before it was not large. The same may be said of the Mechanical Section, in which only seven papers are recorded as read. Prof. Hitchcock, in the section of Geology and Geography, took the "Early History of the North American Continent" as the subject of his address, in which he favours the idea that the bulk of the early crystalline rocks are of igneous origin, being metamorphosed volcanic rocks or tuffs. Ice and its leavings form the subject of a large proportion of the papers read before this section. More than one of these is of much interest, especially that by Mr. W. Upham on the Minnesota Valley in the Ice Age. Messrs. H. C. Bolton and A. A. Julien describe "The Singing Beach of Manchester, Mass.," noticing in the course of the paper the sonorous sand in the Island of Eigg (Hebrides), as well as others on record. It results from their observations that the sound is due to the grains, which are not rounded, but have flat and angular surfaces. It is, we think, undoubtedly a vibration phenomenon. We are acquainted (probably the fact is common) with a small screw-tap in a lavatory, which is loudly sonorous when a certain amount of water is allowed to issue, but silent in other positions. Prof. W. J. Beal, in addressing the Section of Biology, deals with "Agriculture, its Needs and Opportunities;" and the Section received a considerable number of interesting communications. Dr. Franklin B. Hough addressed the Economic Section on the method of statistics, and the address of Mr. E. B. Elliott, delivered to the same Section at the preceding Montreal meeting, is printed in this volume. This Section does not appear to receive nearly so many communications as the corresponding one of the British Association. The address of Prof. O. T. Mason to the Section of Anthropology deals with the scope and value of anthropological studies, and a considerable number of interesting papers were read. Those relating to mound-building may be of service to European archaeologists as offering suggestions which may help in the interpretation of some of the earthworks in the Old World.

LETTERS TO THE EDITOR

The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

On the Terminology of the Mathematical Theory of Elasticity

THE late Dr. Todhunter left, in an incomplete state, a valuable "History of the Mathematical Theories of Elasticity,"